Exploring the epistemic politics of urban niche experiments

Book Section

Chapter 7

Exploring the Epistemic Politics of Urban Niche Experiments

Authors

Cook, M[a]., Horne, R[b]., Potter, S[a]. and Valdez, AM[a].

a Department of Engineering and Innovation, Open University, United Kingdom

b College of Design and Social Context, RMIT University, Australia

Abstract

Urban experiments have been initiated in several locations to purposively initiate and shape transitions to more sustainable urban socio-technical systems, e.g. for energy, water, mobility. Although knowledges produced within such learning spaces are often presented as logical, technical and rational (Vanolo, 2013 ; Kitchin, 2014), the actors and mechanisms which shape decisions are far from obvious, involving cultures, power relations and multiple logics that are profoundly political (Machin, 2013).

This research presents a case study founded in a phronetic perspective (Flyvbjerg, 2001; Avelino and Grin, 2017), unpacking the epistemological politics of an urban experiment taking place within a 'smart city' programme. A 'smart transport' application for mobile phones, 'MotionMap' was developed to transform the mobility system of Milton Keynes, an expanding city located 80 km to the north of London, UK.

The case study recognises power relations and reveals how various actors engaged in the development of this application have further rendered the MK mobility socio-technical system an object of urban governance.

Exploring the Epistemic Politics of Urban Niche Experiments

1- Introduction

Cities play a significant role in responding to climate change (UN, 2014; IPCC 2014). A growing range of actors have sought to mobilise action in response to this urgent agenda, including transnational organizations, national governments and local administrations. Such interventions have fruitfully been considered in terms of experiments to recognise their often tentative nature, the sense of testing or establishing practice and the ways in which they are used as means of supporting or contesting knowledge claims and discursive positions. Socio-technical experiments addressing the urban dimensions of climate change, often framed as 'smart city' programmes, create new forms of political space within the city, intersecting public and private authority. Experiments are primarily enacted through forms of technical intervention in infrastructure networks, drawing attention to the importance of such sites in urban climate politics (Castán-Broto and Bulkeley, 2013).

Analyses of urban climate governance are needed that engage with the multiple actors through which governing is conducted. As local authorities seek to engage with climate change with limited resources and knowledge they invariably turn to an enabling mode of governance that depends on engaging with multiple actors, discrete sources of financial assistance, and often on 'reframing' climate change as an issue related to core agendas (economic growth, congestion, air pollution, urban planning and so on). The patchwork of responses thus produced has been criticised as indicative of a lack of capacity to coordinate and deliver an integrated, planned approach to urban climate governance (Corfee-Morlot et al., 2011). Other authors, however, see it as a process of variation and selection that can usefully adapt to uncertainties associated with the feasibility of different approaches and difficulties in identifying the intended and unintended effects of governance actions and strategies (Rotmans and Loorbach, 2010; Avelino and Grin, 2017).

The relatively protected spaces in which innovation and experimentation takes place, conceptualized as niches, have been presented as critical to the process of socio-technical change (Hoogma et al., 2004; Smith and Raven, 2012). As innovative technologies are applied in a social setting, novel forms of social organization co-evolve with technological artefacts and practices. Although the changes that result from urban niche experiments are often presented as logical, technical and rational, the actors and mechanisms which shape decisions are far from obvious, involving cultures, power relations and multiple logics that are profoundly political (cf. chapters 1 & 2). The processes of sense-making within the niche may reshape political rationalities as well as be reshaped by them. Drawing on the work of Flyvbjerg (2001) on *phronetic planning*, this chapter contributes to the growing body of knowledge which explicates the epistemological politics of urban experiments.

We start in section 2 by discussing the phronetic approach and growing interest in the issue of power and empowerment in innovation experiments. Case study research is presented in section 3 to provide in depth insights on an urban niche experiment in which a smart innovation 'MotionMap' is introduced. MotionMap is a mobile phone application that draws data from a variety of sources including governmental and corporate databases as well as feeds from custom-made sensors, proving real time data about travel flows in the city. Like its commercial counterparts, such as Google Maps or Waze, MotionMap provides multi-modal routing and congestion warnings. However, MotionMap is intended to also contribute to public policy objectives, providing a platform for exploring a variety of approaches to mobility in the city.

The case study is analysed to identify the qualities of MotionMap as the visible, interactive interface for a heterogeneous array of infrastructures, databases, sensors, commuters, policymakers, visions and narratives assembled within a niche. Flyvbjerg's approach enabled us to explore how niche activities are shaped by political rationalities and, in turn, shape these. This chapter therefore considers how a smart transport application (re)configures who gets what and with what consequences. And more generally, we explore the mechanisms of power at play as the interests, identities and interventions are influenced and shaped by the knowledge configuration performed by the application. Crucially as part of this analysis, the epistemic controversies (e.g. in determining the relevant qualities of transport flow to include) involved in the making of the application are explored. Cumulatively, the analysis thus covers the four concerns that were described in Chapter 1 as being central to an epistemic politics perspective, but this is achieved through the application of the phronetic approach.

2- The Phronetic Perspective

Studies of socio-technical transitions have only recently started to engage with spatial and urban disciplinary perspectives (Coenen and Truffer, 2012; Loorbach 2016; Truffer, Murphy and Raven, 2015; Moore et al, 2017). In tandem, in response to challenges from multiple quarters for socio-technical studies to account for power (Geels, 2014) there is a growing interest in the study of shifting power relations between actors in sustainability transitions (Avelino, 2009; Avelino and Wittmayer, 2016). Accepting that things evolve in unpredictable ways and alignments of multiple actors, technologies, knowledge, social structures and policy settings occur over particular periods of time and in particular urban settings, the essential starting observation is that it matters who does the aligning, how, where, when and in whose interests. Avelino (2009) reveals the paradoxical nature of empowerment within urban experiments, which often require participants in participative empowering processes to be already empowered with conventions, language, concepts and relationships. Additionally, strategic language games enable powerful actors to exercise control over supposedly open engagement processes through subtle shifts in the definitions of 'sustainability' or 'empowerment' (Avelino and Wittmayer, 2016) which may take experiments in radically different directions.

Avelino's perspectives on empowerment can be usefully complemented with the insights about values, knowledges and power found in the work of Bent Flyvbjerg (1998; 2001; 2004) who proposed a *phronetic* approach to engage with power relationships and rationalities in planning. The Aalborg case shows how two powerful actors (the City Planning Department and Chamber of Commerce) draw on the same evidence base to make two quite different arguments that ultimately affect the Aalborg redevelopment project. The rational choice discourse rests on the notion that if decisions are rational, then participation isn't required. The phronetic perspective, however, reveals how rationalities are not as value-neutral as they may appear to be. Focused on the *Real Politik* [i]of such projects, Flyvbjerg work therefore questions the democratic focus on rationality. In citing Flyvbjerg's work, Avelino and Grin (2017) argue that (a) the work of analysing power rationalities and (b) that of making judgements about what *should* be constitute the 'is' and 'should' approaches respectively in social sciences and both are valuable in socio-technical transitions studies. In other words, showing that multiple arguments may be made by drawing on the same sources reveals that rationality is far from value free and that research should attend to not only instrumental rationality, but value rationality too. In this way, Flyvbjerg turns the Baconian dictum ‘Knowledge is Power’ on its head – Power *is* knowledge. Attending to the ‘should’, he also encourages engagement with everyday practices and the need to generate useful results that *matter.*

Flyvbjerg (2001) draws upon the Aristotelian idea of *phronesis* which is variously translated today as practical wisdom, practical judgement, common sense, or prudence as an overarching banner for his approach. Similar to other practice based research (cf. Guy and Moore, 2004), a phronetic approach amounts to a call for academics to engage with practice and help decision makers critically reflect on, among other things, their own processes.

The principal objective of the phronetic approach is to clarify values, interests and power relations as a basis for praxis. It is argued by Flyvbjerg (2001) that this objective can be met by focusing on the following value rational questions:

1. Where are we going?
2. Who gains and who loses, and by which mechanisms of power?
3. Is the development desirable
4. What, if anything, should we do about it?

Flyvbjerg’s questions are profoundly about power. Further, following the idea of Phronesis, the ‘we’ referred to in questions 1 and 4 are researchers asking questions and those who share the concerns of the researchers in the community being studied. Here we should note that Flyvbjerg is not looking for universal rules, as the particularities of various contexts and phenomena must be taken into account. In other words, ‘We’ will always be situated in relation to a specific context. The absence of ‘they’ suggests that research is not conducted from ‘no where’ and that the results of research rightly affect developments. Here the approach stresses that no single actor has sufficient wisdom and experience to give complete answers to all four questions, whatever those questions might be for a specific problematic.

Phronetic research is problem relevant research which questions, among other things, how towns and cities are redeveloped. It is not method driven; indeed, various methods can be drawn upon as necessary to address specific issues at hand. Research that effectively answers the four value rational questions detailed above as a basis for action is valued more than methodological orthodoxy.

The questions at the heart of phronetic research balance instrumental rationality with value rationality and increase the capacity of researchers, planners and those planned to think and act in value-relational terms. Such an approach inevitably leads to questions about foundationalism versus relativism: the view that there are central values that can be rationally and universally grounded, versus the view that one set of values is as good as another (Flybjerg, 2001). To address this concern, Flyvbjerg argues that the rejection of foundationalism implied by *phronetic* research does not leave researchers 'normless'. Instead, the point of departure is their *attitude* to the situation in the context under study – informed by a common view among a specific reference group to which the researchers belong.

Thus, in researching the smart transport experiment that took place in Milton Keynes (MK) we must be explicit about our own position, conscious of social difference and somewhat distrustful of neo-liberal narratives that often imply that efficiency and economic growth are key to the improvement of urban sustainability and quality of life. We oppose such a neo-liberal smart city narrative because we question its epistemic grounds, particularly its logical positivism, which implicitly holds that the world is, in principle, perfectly knowable, its contents enumerable and their relations capable of being meaningfully encoded in the state of a technical system (Greenfield, 2013). We also question the assumption that solutions to urban problems can be arrived at algorithmically and applied transparently, dispassionately and in a manner free from politics (ibid). Particularly, as the authorship of an algorithm intended to guide the distribution of civic resources is itself an inherently political act (Kitchin, 2017), we are concerned by narratives that make urban experiments apolitical, bypassing mechanisms of democratic accountability and rendering the mechanisms of power invisible. Thus, making such mechanisms of power visible is a central concern driving this research.

It cannot be overstated that power is central to phronetic research. Indeed, it argues that rationality without power is irrelevant (Flyvbjerg, 1998), which chimes with Friedman's (1998) 'inevitable question of power'. In phronetic research both the Weberian questions

‘Who governs?’ and ‘What governmental rationalities are at work when those who govern govern?’ (Foucault, 1979) are mobilised to explore value rationality in specific contexts. In turn, these emphasise the epistemic dimension of power: *Knowledge and power, truth and power, rationality and power are analytically inseparable from each other; power produces knowledge and knowledge produces power* (Flyvbjerg, 2004).

The phronetic perspective proved highly relevant for the case study. Epistemic contests regarding the definitions of empowerment, sustainability, smartness and even motion, and the various alternatives to operationalize them through the sensors and data infrastructures of a ‘smart city’ proved germane to understanding the relation of knowledge and power in the development of MotionMap.

3- Case Study – Motion Map

> *Aristotle explicitly identifies knowledge of “particular circumstances” as the main ingredient of phronesis. Foucault similarly worked according to the dictum “never lose sight of reference to a concrete example.” Phronetic research thus benefits from focusing on case studies, precedents and exemplars.*
>
> (Flyvbjerg, 2004, p 135)

Smart technologies are often discussed in the abstract, with critics and advocates dissecting the concept itself with limited reference to actually existing smart cities (Wiig et al., 2015). When concrete examples are discussed, they are often documented from a technical perspective: academics working on developing smart city technologies and policy formulations—especially those in the sciences and computational social sciences—position their work as pragmatic and non-ideological. In consequence, discussion of the politics, power and epistemic conflicts that take place as smart city projects develop on the ground are frequently underdeveloped (Kitchin, 2014). Here, the importance of unpacking the epistemological politics of urban experiments will be illustrated through case study research which provides in depth insights on a ‘smart’ urban niche experiment. A coalition of policy, technology and academy actors supported the development of a smart innovation, ‘MotionMap’, broadly envisioned as an empowering application that would use real-time data to transform the transport system of MK and contribute to the economic development of the city.

3.1 Background

MK is a rapidly-growing new town that was founded in 1967. Prior to the designation of MK, the area had a population of less than 50,000. Today, it is estimated to have over 250,000 residents. Between 2004 and 2013, MK was the fastest growing UK city, expanding by 16.5 per cent (Centre for Cities, 2015). Local government, universities and industrial actors found that the rapidly growing new town provided a suitable venue to explore the benefits of sustainable technologies and to develop new business models for them. Projects such as the demonstration of the world's first solar-powered house in 1972, pioneering energy standards in buildings in 1979 and the UK's first kerbside recycling collection scheme in 1992 contributed to the reputation of MK as an innovation test bed (PRP Architects, 2010). The strategic positioning of MK as an experimental city has been deliberate, with the city council consistently developing the MK "brand" as a test bed for sustainable living initiatives: a place where business and governmental actors can test new ideas and set standards for future adoption around the UK (PRP Architects, 2010; MKC, 2013; MKC, 2010; MKC, 2011)

Several urban transition experiments being deployed in MK are related to ideas of sustainable transport, a growing concern for city authorities. Despite its relatively small (but rapidly growing) population of approximately 250,000 people, the automobility problem in MK is eminently suburban. The city was built to a design dating from 1969-71 that sought to facilitate the use of the private car for all journey purposes (Llewellyn-Davies, 1968): a one kilometre grid of high capacity, high speed 'grid roads' and extensive car parking in all areas, coupled with low density development. MK has an extensive network of cycling and pedestrian paths (colloquially known as 'redways') but they were designed for leisure (Clapson, 2013: p 15,16,64) and are widely considered unsuitable for commuting (Edwards, 2001; Franklin, 1999). MK is consistently ranked last or near-last in car dependency scorecards (i.e. amongst the most dependent) (Campaign for Better Transport, 2014) and rapid city growth is expected to aggravate the issue. Because of the combination of high car dependence and rapid population growth, traffic growth of 60% is expected in MK by 2026 (MKC, 2012a), but local authorities will only be able to provide an extra 25% capacity through junction improvements and other measures.

The city council has explored various informational and behavioural approaches for making more efficient use of the existing infrastructure through a variety of pilots centred on water, energy and transport technologies, among others. In the case of MotionMap, the interests of the council, technology developers and academia were aligned, with a smart city project providing an arena for exploring the application of real-time data for addressing transport problems.

Milton Keynes Council has traditionally supported transition experiments through an approach based on enabling governance: instead of funding and controlling traditional solutions, the council tends to encourage and support various commercial, academic and community actors interested in running niche experiments. MotionMap, the application analysed in this case study, was not commissioned by the council, but was part of the council-facilitated MK:Smart, a £16 million (circa 18.25 million Euros) smart city programme involving a network of industry, community and research actors. The programme, funded by the Higher Education Funding Council for England (HEFCE), was led by the Open University. MotionMap was the key transport output of the programme, based on the premise that high availability of personalised information on travel choices could have a similar, if not greater, impact to that of Personalised Travel Plans which have been used to provide enhanced travel information for households. Traffic reductions of up to 11% have been achieved through the adoption of such plans (Cairns et al, 2008).

Design and development of the application was led by the University of Cambridge, in collaboration with the Open University and various start-up companies with the technical skills required for deploying sensors and developing visualizations, analytics and routing algorithms. The project was also supported by Milton Keynes Council and by partners such as BT, Huawei, Samsung and Tech Mahindra, who contributed to the data infrastructures for the smart city project in which MotionMap was embedded, but did not have direct input in the design of the application. Data from a variety of sensors and feeds relevant to transport, water and energy were stored and made available through a “Data Hub” managed by the OU as part of the MK:Smart programme (d’Aquin et al., 2016). Data were made publicly available with the expectation that SMEs, entrepreneurs and civic hackers would develop their own smart applications. A Cambridge-based start-up was commissioned by MK:Smart to develop MotionMap as a flagship application for the transport work package.

Project leaders envisioned MotionMap as an application accessible through mobile devices that would allow users to make spontaneous public transport decisions with increased efficiency and convenience. The real time sensing and visualization of travel flows made possible by MotionMap would facilitate “spontaneous real-time choices about transport which spring from the exercise of personal preference rather than bureaucratic coercion” which were expected to lead to substantial (and beneficial) changes to the nature and pattern of movements within the city" (MK:Smart, 2014). Like its commercial counterparts, such as Google Maps, CityMapper or Waze, MotionMap was designed to provide multi-modal routing and congestion warnings. However, MotionMap was also intended to also contribute to public policy objectives, providing a platform for exploring a variety of approaches to mobility in the city. Real-time data about transport flows captured through the application and its related sensing infrastructure would feed into city dashboards and inform the city’s traffic models.

The somewhat abstract concept of “smart transport”, and particularly the unexpectedly malleable ideas of “transport flows” and “motion”, were subject to exploration, negotiation and epistemic debate throughout the life of the project.

3.2 Method

A variety of qualitative data from primary and secondary sources were collated and analysed following a clustering and coding method (cf. Miles and Huberman, 1994). Policy and corporate literature on smart cities provided insight about the stated goals of national and transnational actors in policy and technology organizations. Sources of data included:

- Promotional materials and articles in popular media (Sheffield Smart Lab, 2015; DriveMidlands, 2016; Cisco, 2014; Connect Cambridgeshire, 2016; Cambridge News, 2016; OneMK, 2016)
- A smart city perspective study by MK Council (MKC 2012b);
- A feasibility study assessing MK’s potential participation in the future cities demonstrator programme (TSB, 2013);

- A comparative analysis of the feasibility studies performed by a transnational consultancy firm (TSB & ARUP, 2013);
- A long-term vision for the city (MKF2050, 2016), and
- Academic articles produced by researchers working in MK:Smart (d'Aquin et al., 2014; d'Aquin et al., 2015; Potter et al., 2015; Wolff et al., 2015a; Wolff et al., 2015b; Montaner et al., 2015; Gooch et al., 2015; Okada et al., 2015; Gaved and Peasgood, 2015; Williamson et al., 2015; Valdez et al., 2018; Caird et al., 2016).

The somewhat idealized accounts about the development of the smart city identified in secondary data were contrasted with primary data collected during a series of MK:Smart citizen engagement workshops and secondary data produced by members of the coalition responsible for the smart city programme in MK.

Primary data were predominantly collected through the observation of a series of citizen engagement workshops through which OU researchers (including two of the authors of this chapter) sought to engage citizens as co-creators of MotionMap. Discussions prompted through iterative interactions of participants and prototypes were used to explore the co-constitution of the technical and the social. Citizen groups interested in specific transport issues were contacted through community coordinators with extensive links to the voluntary and community sectors (CAMK 2014 a, 2014b). Given the relatively low levels of bus usership, walking and cycling for commuters in the city (4%, 7% and 3% respectively), this was necessary so the populations of interest could be reached. Four of the workshops were open to the general public but targeted citizen groups interested in specific transport issues, who were contacted through community coordinators; the remaining two workshops were closed and the participation of specific project partners was sought (MK:Smart partners and prospective entrepreneurs interested in developing data-driven business models). 12-40 participants attended each workshop and were separated into smaller groups to facilitate discussion. Workshop guides with suggested questions and topics to discuss were developed and used to stimulate group discussions. Data were collected through notes taken by workshop facilitators working with each group, from feedback forms provided to participants and from incidental outputs of the group exercises (for example, sticky notes and flipboard sheets with notes from brainstorming sessions). The workshops were used for data collection, but also to inform the design of the application and to interrogate the assumptions of the 'smart' experiment itself. The original vision for MotionMap, with real-time data being used to support a more efficient use of physical infrastructure, implied a particular conception about the relationship between power and urban knowledge: citizens would be “empowered” to make more informed transport choices.

While this vision of empowerment was not interrogated critically in early stages of the project, MK:Smart as a whole had a different (yet compatible) ethos of empowerment, one where citizens would be “empowered” through their participation as co-creators of smart city applications. The workshops were meant to support this conception of empowerment, which is widely held in academic and corporate literature on smart cities. Building on the premise that city authorities and planners may not always be able to predict which smart urban services are needed to tackle issues as they arise, the beneficial economic and societal outcomes of smart city programmes are expected to emerge through a mix of formal planning, market forces and, crucially, citizen involvement (BSI, 2014; Osborne Clarke, 2015; Greenfield, 2013; Vilajosana et al., 2013; Hollands, 2015).

The workshops used non-functional mock-ups, intended to be very abstract and open to interpretation. For example, one of the very first mock-ups was a static image of a ‘heat map’ without any labels and the meaning of the heat map was left intentionally ambiguous so it could be interpreted, for example, as an indicator of traffic congestion or as pedestrian density. Those limited prototypes were refined in an iterative fashion, with the expectation that results from the workshop would feed into the specifications used by the software development team. Abstract mock-ups were followed by non-functional mock-ups in which the expected functionality was made more explicit (Figure 7.1). Later, interactive prototypes with limited functionality and a real connection to sensors deployed in the city centre became available and were included in the discussions (Figure 7.2).

<FIGURE 7.1 HERE>

<FIGURE 7.2 HERE>

3.3 Analysis

3.3.1 Where are we going? Who wins and who loses?

Smart city projects are frequently defined in vague, optimistic language so that they may claim a broad legitimacy for guiding stakeholders and constitute an attractive reference for actors at all levels and across sectors (Wolfram, 2012). However, it remains rather open what the actual pursuit of a 'smart city' is and, therefore, which winners and losers we are to expect from its deployment (ibid). In the case of MotionMap, iterative encounters between citizens and prototypes revealed that there was not a unique answer to the phronetic questions. There was a tension, which remained unresolved until the conclusion of the project, between various visions about the potential direction of the experiment. The design of early prototypes was shaped by a strategy based on the use of big data to increase the efficiency of transport infrastructures: the sensing infrastructure of the smart city would be used to make citizen activities visible so that users could voluntarily manage their demand of transport services. Citizen workshops suggested a subtly different application, however, that implied big differences in visions about real-time knowledge and power.

Early MotionMap prototypes implemented the original vision of the project leadership and city council, which assumed that users would value transport information if they could use it to travel more efficiently, avoiding congestion by changing the route or time of their journeys, or avoiding travel altogether if efficient alternatives were not available (voluntary demand management). The application was largely intended to cater to drivers, as 71% of the commuters in MK rely on private cars for their daily commute. However, workshop participants did not think that the system as designed would lead to significant changes in their car driving behaviour. Habitual drivers were already familiar with the patterns of congestion in the city:

"We have been having this conversation since 30 years ago. Gridlock happens 2 hours out of 24 and everyone knows it, but everyone has to get to work at peak hour anyway."

In contrast to the relative scepticism of drivers, workshop participants that relied on public transport, walking and cycling were optimistic about the potential impact that real time information would have on their travel experiences. However, they did not discuss the expected benefits in terms of increased efficiency. Participants generally considered that all alternatives to the car involved a loss of control and reliability. Non-drivers saw the potential to use smart technologies to have a more reliable experience, to increase their control over their travel and to increase the accountability of public transport providers. Thus, in addition to being "empowered" to make better choices, they also expected to be empowered to exert pressure for change in the transport system.

For example, many bus stops in MK have real time information boards, but users found the information unreliable. Several users reported that sometimes they would spend 20-30 minutes waiting by the bus stop for a bus that according to the official information was just around the corner and sometimes buses would seem to just disappear from the application. Their rough estimate was that the information was accurate 90% of the time and this became problematic for frequent bus users, particularly when planning multi-leg, multi-modal journeys.

Bus users felt disempowered by the situation, stating that bus companies appear to dictate their own rules with little accountability to users or local authorities. Data related to scheduling, routing and incident reporting was distrusted, as there was a perception that 'it's very easy to manipulate data if you are a bus company'.

Workshop participants considered that multi-modal journeys would greatly benefit from sensing systems complemented through crowdsourced, real-time reports about transport services. This information would be of immediate use to other bus passengers and the accumulated records provided by this monitoring activity would make transport providers more accountable. This, in effect, would counteract the existing disempowering relationship between bus users and service providers.

Cyclists and pedestrians were also interested in crowdsourced information that would let them know about hazards like flooded underpasses, footpaths with insufficient night-time lighting, or cycle paths made dangerous because of broken glass. While the specific information required by bus users, cyclists and pedestrians was different, the intended use for information was similar in all cases: users wanted to have the information available in real time so they could re-route around broken links and they also wanted to know that information would be kept on record so city managers and service providers could be held accountable.

The original vision for MotionMap could potentially address the traffic problems caused by the rapid growth of the city, but it would largely maintain the status quo, with the same power structures in place and the same mix of transport modes but operating more efficiently. The alternative suggested by citizens would complement sensor data with crowdsourced reports to give users more power over transport service providers. Instead of making citizens (as commuters) visible to increase their efficiency, the actions of transport and infrastructure providers would be made visible, increasing accountability and potentially challenging existing power structures.

3.3.2 What mechanisms of power are in play?

Data were central to various mechanisms of power observed in the MotionMap experiment, either through direct control of its access or, more subtly, by controlling the categories and definitions used to understand urban flows. Smart cities make vast volumes of urban information available to citizens, businesses and city managers. Data is drawn from a wide variety of sources and systems, collected through pervasive and ubiquitous computing and digitally instrumented devices built into the very fabric of urban environments. An unprecedented level of access to data about the city is expected to facilitate the real-time management of its resources, improving the efficiency of public service delivery, the sustainability of the urban environment and the quality of life of citizens (Cisco, 2012; BIS, 2013). This was, indeed, the approach pursued by the designers of MotionMap:

> *We're focusing our efforts on trying to extract all the information that is available around the city and putting it together in a form that is easy to understand and use. So, we're developing an app called MotionMap. Its purpose is to be able to tell you on your handheld device, in a very simple way, how busy it is at any place in the city…Our job now is to research how best to do that. How do we measure busyness? How do we put this notion of busyness in the hands of the user? How then might you nudge the users to make the decision which will help the overall picture of congestion be relieved? (MK:Smart, 2014)*

Here, we use the term ‘epistemic controversy’ to characterize the tensions induced by disagreements about the best way to ‘extract all the information that is available around the city’. The field of urban studies is subject to periodic epistemic crises. A recurrent question in the epistemology of the urban is: through what categories, methods and cartographies should urban life be understood (Brenner and Schmid, 2015)? The latest of those crises has been caused by the rapid penetration of sensors and informational infrastructures capable of processing huge data assemblages (Gleeson 2014, 348). Deployment of such infrastructures is often pursued uncritically, based on the misleading assumption that “*data are transparent, that information is self-evident, the fundamental stuff of truth itself. If we are not careful, in other words, our zeal for more and more data can become a faith in their neutrality and autonomy, their objectivity*” (Gitelman and Jackson 2013, pp 2-3).

In the case of MotionMap, epistemic controversies centered on two issues: the selection of data sources and the co-design of the envisioned functionalities for the application.

In practice, only a fraction of the data sources sought by the developers of MotionMap could be negotiated and implemented. For example, it was not possible to reach a workable compromise when seeking permission for installing “busyness” sensors in commercial areas: managers of commercial spaces considered that footfall information was commercially sensitive and were unwilling to make it publicly available, but keeping it private would have gone against the open data ethos of the MK:Smart project. Additionally, it became clear that the interests of users and those of business owners were not always aligned. Part of the vision for MotionMap was that a user might see the city centre being really busy and change their plans to come another day or choose to go to a less busy department store over another more crowded one. The managers of the shunned store would be unlikely to be pleased in that hypothetical scenario.

Similar concerns over the commercial sensitivity, cost effectiveness and technical feasibility of using various data sources led to a series of negotiations with other stakeholders such as taxi and bus companies and parking managers, some more successful than others. Consequently, data streams feeding into the early versions of MotionMap were limited compared to the original vision. Available feeds were, nevertheless, sufficient for the purposes of development and included interactive maps, real-time routing information provided by public transport operators; occupancy information from managers of a small number of parking areas in the city centre; and main road traffic information purchased through “data as a service” agreements with corporate providers.

While negotiating access to pre-existing data and to senseable spaces was important for defining the nature of MotionMap, data that were not available from existing sources could potentially be captured by deploying new sensors. A variety of sensing devices were deployed in certain areas of MK specifically for these purposes. Various approaches were trialled, but in the end automated image analysis of CCTV was selected because of its cost effectiveness and ease of deployment. The sensors, which relied on inexpensive cameras, microprocessors and sophisticated algorithms, were originally designed to help owners and managers of public spaces to understand exactly how those spaces are used, to facilitate a more intelligent and dynamic allocation of resources and to better forward plan (Cisco, 2014). Drawing on lessons learned from the MotionMap project, the start-up company developing the technology updated their vision, emphasizing how solutions based on their technology can empower citizens so they can make better choices about how they use their city (SheffieldSmartLab, 2016). Arguably, this is a somewhat limited conception of empowerment, as users are only “empowered” to make more efficient choices within the existing system and structures of power. However, as discussed in section 3.3.1, real time information such as the one provided by the sensors could potentially be used to facilitate other forms of empowerment more disruptive of the status quo.

3.3.3 Is the development desirable? What, if anything, should we do about it?

As discussed in section 2 of this chapter, answers to phronetic questions cannot claim to be rational and value neutral but are grounded in the researchers' attitudes, which must be made explicit. Thus, we re-state our commitment to equal, democratic and liveable cities and also, importantly, our concern with making the mechanisms of power visible. Urban experiments are often framed as ‘empowering’, with policy-makers claiming that their initiatives will ‘empower’ ‘the community’. Critical perspectives on empowerment, however, emphasize that attempts to empower others may have the paradoxical effect of disempowering them through the creation of a new dependency relation (e.g. Hardy & Leiba-O'Sullivan, 1998). The spread of ‘participative events’ throughout a policy field may even have counter-productive effects as the ‘participants’ may be confirmed in their overall impression that they are “pawns in some new policy trend” (Avelino and Wittmayer, 2016). Avelino (2011) suggests that the success of empowerment in transitions can only be evaluated ‘at the moment of physical materialization, possession and profit’: who has materialized the new institutional arrangements, who possesses the new resources, who profits from them and who’s goals have been realized?

Reflecting on Avelino’s questions, MotionMap had limited success as a means of empowering its users. It proved difficult for the MotionMap development team to pursue a model that would give users ownership and control of the data, or one that would realize the goals identified through the workshops. In development, the focus for MotionMap shifted from active user engagement and user ownership of data (for example through crowdsourcing data on bus, parking and cycleways) towards technical solution to obtain the same data (visual analytic sensors). Various aspects of the development process contributed to this.

One aspect was that the project had a strong technical team and capabilities built around the gathering of data from instrumented sources. Its background and culture, although open to learning from co-creation and crowdsourcing experience, was not centred on such approaches. This is a common situation in big data Smart City projects and also in commercial big data approaches (such as the way Google Maps detect mobile phone signals to map traffic congestion).

A second aspect was that, even if the team had sought a crowdsourced rather than an instrumentation approach, user ‘buy-in’ to MotionMap was low and selective. Crowdsourcing could be viewed as inferior to sensors in providing reliable information. Even established commercial crowdsourcing systems have very patchy reporting around MK – and is at a level far too low to generate reliable data for an application like MotionMap. This suggests that Smart City projects seeking an empowering approach may need an initial phase built around instrumentation and sensors. This will provide the functionality to build up the critical user base to then move on to include enhancing by crowdsourced information. However, this sort of model very much constrains the co-creation role for users.

A third aspect is that users sought empowerment for a different purpose than was envisaged by the team developing MotionMap. The overarching aim of MotionMap was to provide functional travel information that would help users to make more informed travel choices. That would then yield benefits in terms of congestion reduction and economic development. But in the workshops, this functionality was not particularly valued. It could be that, in practice (like many new technology products), people would find MotionMap more useful than envisaged hypothetically. This could well prove to be the case. However, it was notable that the workshop participants sought empowerment through MotionMap for very different purposes than travel information functionality. One was they saw it as a way for them to work as communities of interest (e.g. cyclists reporting to each other glass on the cyclepaths). Customising for specialist interests was also mentioned (which requires the application to be designed in a way that can be customised with relatively basic programming knowledge through an Application Programming Interface (API)).

A rather different empowering purpose was that users wanted to use MotionMap to hold providers and authorities to account. For example, crowdsourced information might be used to ensure the reliability and punctuality of the bus service or to ensure that pedestrian areas have sufficient illumination and are in good repair. Through ownership and control of transport data, users would counteract the imbalance of power and their dependency on transport service providers. This was particularly strongly felt by bus users and cycle groups. However, there is a situation that, due to the existing power imbalance, such groups have a lobbying and pressure group culture and regime. They thus react within this regime and found it quite difficult to envisage how MotionMap might shift them to become co-creators of a service, rather than lobbying the service providers.

This set of non-travel function purposes did not readily map onto the original aims for MotionMap of congestion relief and economic development. In consequence, the meaning and the potential of "Smart Transport" was contested. There is certainly potential for using smart technologies to enhance traditional city and transport planning aims, but such optimization may not be deemed desirable by users. Once new technologies such as big data applications are deployed to this domain, it should be recognised that the desires and aspirations of consumers in the digital economy will begin to emerge. People will no longer view themselves as passive users of functional services, but as interactive users that address wider lifestyle desires. The tension in the purpose of MotionMap is one of seeking to address traditional city planning and transport aims with a smart application powered by big data, moving into the digital technology sphere. It perhaps needs to be recognised that this will generate new user expectations for interactive and co-creation involvement that will become as much a part of public policy as the traditional engineering and planning goals around which professional practice and competencies have been built. As transport policy initiatives move into the digital arena, analogue behaviours and thinking need to shift too.

4- Epilogue and discussion

At the time of writing the MK:Smart programme reached its formal conclusion. The conditions of funding stipulated that the programme would run until 2017, and that projects initiated by the programme would become independent and financially self-sustainable afterwards. Having secured support of local authorities in MK and Cambridge, the MotionMap application is still being developed by one of the startup companies in the original coalition. A second startup maintains and expands the sensing infrastructures deployed for the MK:Smart experiment, with funding and support from the city council. The sensor network associated with the application is nearing the levels of coverage needed to deliver practical results, providing real time information on approximately 70% of the buses used by the main transport provider in the city, 85% of the pedestrian activity in the city centre, nearly 100% of the traffic in the main grid road network, and thousands of parking spaces. MotionMap as a concept remains attractive from a policy perspective. Through a series of planning activities taking place between 2016 and 2017, MotionMap was made part of the medium and long term transport strategy advocated by the MK Futures 2050 Commission, an independent body launched by Milton Keynes Council to address potential longer term futures for MK. MotionMap is envisioned as an enabler of new forms of mobility to ensure everyone who lives, works, studies or does business in the city is able to "move freely and on-demand" (Transport innovation task and finish group, 2016; MKFC2050, 2016). The sensors and data infrastructures developed for the niche in which MotionMap was initially developed are being adapted to other applications and locales (UKAuthority, 2016; Highways Industry 2017) and MotionMap is travelling to new locations (Connect Cambridgeshire, 2016; Cambridge News, 2016), where it is being adapted and has become the subject of new epistemic debates. There is potential for the smart transport innovation to break out beyond the experimental niche, leading to a transition towards a smart region, even as the meaning of smart transport in MK is still being explored and contested.

The case study reveals how various actors (including two universities, the local authority and citizens) engaged in the development of this application have further rendered the MK mobility socio-technical system an object of urban governance. Prototype MotionMap designs were developed by and presented to various actors in multiple institutional arena: the MK Transport Innovation group, Citizen Labs and project team meetings. This process focused on deciding which transport modes and infrastructures to map and the qualities of these which would be most relevant and most readily translated into real-time data. Qualitative data collected revealed a rich picture of how arguments are made to justify views of the mobility system, how powerful actors were mobilised through notions of 'efficiency' to effect transition to more sustainable urban mobilities' (e.g. to reduce carbon emissions) and how temporal, spatial, institutional and socio-cultural boundaries are constructed in urban experiments and shape such processes.

Here, we found that a phronetic perspective proved useful to inform the theoretical sensitivity of the research, even if definite answers could not be reached for a smart transport application that is still being developed and negotiated. Additionally, we found that the task was made even more difficult because of language games that become part of the process of negotiation and a mechanism of power. Notions of sustainability and smartness became strategically malleable (Avelino and Grin, 2016; Smith and Stirling, 2008). For example, increased efficiency in the use of the road network may be primarily motivated by cost reductions but is framed as a mechanism for reducing congestion (i.e., good for 'people') and emissions (i.e., good for 'planet'). In this way, the primary goal of economic optimization is framed in terms of 'sustainability' (Avelino and Grin, 2017).

In retrospect, the development of MotionMap can be seen as an exercise in developing a local version of the idealized smart city narrative and in balancing its inherent tensions. Various institutions use narratives to elevate some imagined futures above others according them a dominant position for policy purposes, which draws attention away from alternatives (Van Hulst, 2012; Jassanof, 2015). Coalitions of policy and industry actors engage in a collaborative storytelling through the publication of advertising materials, technical prospects, frameworks and policy documents, often conceptualized as roadmaps. This smart city narrative provides direction to the imaginaries and practices of actors concretely building cities through particular pilot projects (Söderström et al, 2014; Bakıcı et al., 2013; Lee et al., 2014). Those idealized narratives make compelling promises of increased efficiency, economic growth, sustainability, quality of life and citizen empowerment (Hollands, 2008; Aoun, 2013; Kitchin, 2014; Albino et al., 2015; Shapiro, 2006; BIS, 2013; Neirotti et al., 2014). The various goals in this vision are generally presented as interconnected and it is implied that they will emerge jointly following the deployment of smart infrastructures. In the case of MotionMap, however, the various promises made by the smart city narrative proved to be somewhat independent from each other. Hence the relevance of the phronetic perspective, that may usefully draw attention to the various dimensions in which the smart city was rendered visible and negotiable.

References

Albino, V., Berardi, U., & Dangelico, R. M. (2015) **“**Smart cities: Definitions, dimensions, performance, and initiatives” *Journal of Urban Technology*, 22(1), 3-21

Aoun, C. (2013) The smart city cornerstone: Urban efficiency (https://www.schneider-electric.com/en/download/document/998-2095-01-30-13_EN/) accessed 28 May 2018

Avelino, F. (2009) “Empowerment and the challenge of applying transition management to ongoing projects” *Policy Sciences*, 42(4), 369-390

Avelino, F. (2011) Power in transition: empowering discourses on sustainability transitions Unpublished PhD Thesis , Dutch Research Institute for Transitions, Erasmus University Rotterdam

Avelino, F., & Grin, J. (2017) “Beyond deconstruction. a reconstructive perspective on sustainability transition governance” *Environmental Innovation and Societal Transitions*, *22*, 15-25

Avelino, F., & Wittmayer, J. M. (2016) “Shifting power relations in sustainability transitions: A multi-actor perspective” *Journal of Environmental Policy & Planning*, 18(5), 628-649

Bakıcı, T., Almirall, E., & Wareham, J. (2013) “A smart city initiative: the case of Barcelona” *Journal of the Knowledge Economy*, 4(2), 135-148

BIS (2013) Smart cities background paper (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/246019/bis-13-1209-smart-cities-background-paper-digital.pdf) accessed 28 May 2018

BSI (2014) PAS 181:2014 Smart city framework - guide to establishing strategies for smart cities and communities (http://shop.bsigroup.com/upload/267775/PAS%20181%20%282014%29.pdf) accessed 28 May 2018

Brenner, N., & Schmid, C. (2015) "Towards a new epistemology of the urban?" *City* 19(2-3) 151-182

Caird, S., Hudson, L., & Kortuem, G. (2016) A tale of evaluation and reporting in UK smart cities (http://www.mksmart.org/wp-content/uploads/2016/04/Tales_Smart_Cities_Final_2016.pdf) accessed 28 May 2018

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., & Goodwin, P. (2008) "Smarter choices: assessing the potential to achieve traffic reduction using soft measures" *Transport Reviews* 28(5) 593-618

Cambridge News (2016) City Deal splashes out on new app to improve journeys in the city http://www.cambridge-news.co.uk/news/cambridge-news/city-deal-splashes-out-new-12083771) accessed 28 May 2018

CAMK (2014a) MK:Smart CitizenLab talks complementary transport systems in Milton Keynes http://www.mksmart.org/blog/2014/05/13/mksmart-citizenlab-talks-complementary-transport-systems-in-milton-keynes/) accessed 28 May 2018

CAMK (2014b) MK Smart - Redways: An asset fit for the future in Milton Keynes (http://eventful.com/miltonkeynes/events/mk-smart-redways-asset-fit-future-/E0-001-069463633-7) accessed 28 May 2018

Campaign for Better Transport (2014) Car dependency scorecard 2014 (http://www.bettertransport.org.uk/sites/default/files/pdfs/Car_Dep_Scorecard_2014_LOW_RES.pdf) accessed 28 May 2018

Castan-Broto, V. and Bulkeley, H. (2013) "Maintaining Climate Change Experiments: Urban political ecology and everyday configuration of urban infrastructure" *International Journal of Urban and Regional Research*, 37 1934-1948

Centre for Cities (2015) Fast-growth cities: The opportunities and challenges ahead (http://www.centreforcities.org/publication/fast-growth-cities-opportunities-and-challenges-for-cambridge-oxford-milton-keynes-swindon-norwich/) accessed 28 May 2018

Cisco (2012) Smart city framework: A systematic process for enabling smart+connected communities (http://www.cisco.com/c/dam/en_us/about/ac79/docs/ps/motm/Smart-City-Framework.pdf) accessed 28 May 2018

Cisco (2014) Startup Spotlight: Alchera Technologies (http://www.cisco.com/assets/global/UK/pdfs/the_ioe_unlocking_the_opportunity_for_uk_startups.pdf) accessed 28 May 2018

Clapson M (2013) *The Plan for Milton Keynes* Routledge, Oxford

Coenen, L. Benneworth, P. and Truffer, B. (2012) "Toward a spatial perspective on sustainability transitions" *Research Policy* 41(6) 968–79

Connect Cambridgeshire (2016) Smart Cambridge supports transport plans (http://www.connectingcambridgeshire.co.uk/smartcamb/) accessed 28 May 2018

Corfee-Morlot, J., Cochran, I., Hallegatte, S., & Teasdale, P. J. (2011) "Multilevel risk governance and urban adaptation policy" *Climatic change* 104(1) 169-197

d'Aquin, M., Adamou, A., Daga, E., Liu, S., Thomas, K., & Motta, E. (2014) "Dealing with diversity in a smart-city datahub" *Proceedings of the Fifth International Conference on Semantics for Smarter Cities-Volume 1280* 68-82

d'Aquin, M., Davies, J., & Motta, E. (2015) "Smart Cities' Data: Challenges and Opportunities for Semantic Technologies" *IEEE Internet Computing* 19(6) 66-70

DriveMidlands (2016) Alchera Technologies Company Pitch (https://www.drivemidlands.co.uk/wp-content/uploads/2016/03/Alchera.pdf) accessed 28 May 2018

Edwards, M. (2001) “City design: what went wrong at Milton Keynes?” *Journal of Urban Design* 6(1) 87-96

Flyvbjerg, B. (1998) *Rationality and power: Democracy in practice* University of Chicago press, Chicago, IL

Flyvbjerg, B. (2001) *Making social science matter: Why social inquiry fails and how it can succeed again* Cambridge University press, Cambridge

Flyvbjerg, B. (2004) “Phronetic planning research: Theoretical and methodological reflections” *Planning Theory & Practice* 5(3) 283-306

Foucault, M. (1979) “On Governmentality” *Ideology & Consciousness* 6 5-21

Foucault, M. (1982) “The subject and power” in: H. Dreyfus & P. Rabinow eds, *Michel Foucault: Beyond Structuralism and Hermeneutics* Harvester Press, Brighton 214–232

Franklin, J. (1999) “Two Decades of the Redway Cycle Paths in Milton Keynes” *Traffic Engineering & Control* 40(7-8) 393-396

Friedmann, J. (1998) “Planning theory revisited” *European Planning Studies* 6(3) 245-253

Geels, F. (2014) “Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective” *Theory, Cult. Soc.* 31 21–40

Geels, F., Berkhout, F., van Vurren, D. (2016) “Bridging analytical approaches for low carbon transitions” *Nature Climate Change* 6(6) 576

Gleeson, B. (2014) *The urban condition* Routledge, London

Gooch, D., Wolff, A., Kortuem, G., & Brown, R. (2015) “Reimagining the role of citizens in

Smart City projects” *Adjunct Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2015 ACM International Symposium on Wearable Computers* 1587-1594

Greenfield, A. (2013) *Against the smart city* Do projects, New York

Guy, S., & Moore, S. A. (Eds.). (2004) *Sustainable architectures: Critical explorations of green building practice in Europe and North America* Routledge, Oxford

Hardy, C., & Leiba-O'Sullivan, S. (1998) “The power behind empowerment: Implications for research and practice” *Human relations* 51(4) 451-483

Highways Industry (2017) Vivacity Labs Secures 3M to boost road safety for Autonomous Vehicles (http://www.highwaysindustry.com/vivacity-labs-secures-3m-to-boost-road-safety-for-autonomous-vehicles/) accessed 28 May 2018

Hollands, R. G. (2008) “Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?” *City* 12(3) 303-320

Hollands, R. G. (2015) “Critical interventions into the corporate smart city” *Cambridge Journal of Regions, Economy and Society* 8(1) 61-77

Hoogma, R., Kemp, R., Schot, J., & Truffer, B. (2004) “Experimenting for Sustainable Transport: the Approach of Strategic Niche Management” *Technology Analysis & Strategic Management* 16(4) 561-566

House of Commons (2016) The Oxford-MK-Cambridge arc (https://hansard.parliament.uk/commons/2016-07-12/debates/16071263000002/TheOxford-MK-CambridgeArc) accessed 28 May 2018

IPCC (2014) Fifth assessment report of the Intergovernmental Panel on Climate Change-Climate Change 2014: impacts, adaptation, and vulnerability (http://www.ipcc.ch/report/ar5/wg2/) accessed 30 May 2018

Jasanoff, S. (2015) “Future imperfect: Science, technology, and the imaginations of modernity” In: Jasanoff S and Kim S-H eds *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* University of Chicago Press, Chicago

Joss, S. (2015) *Sustainable Cities: Governing for Urban Innovation* Palgrave, London

Kitchin, R. (2014) **“**Making sense of smart cities: addressing present shortcomings” *Cambridge Journal of Regions, Economy and Society* 8(1) 131-136

Kitchin, R. (2017) “Thinking critically about and researching algorithms” *Information, Communication & Society* 20(1) 14-29

Lee, J. H., Hancock, M. G., & Hu, M. C. (2014) “Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco” *Technological Forecasting and Social Change* 89 80-99

Llewelyn-Davies, W. Forestier-Walker and Bor, (1968) *Milton Keynes: Interim Report* MKDC, London

Loorbach, D. Wittmayer, J.M. Shiroyama, H. Fujino, J. and Mizuguchi, S. (2016) *Governance of Urban Sustainability Transitions: European and Asian Experiences* Springer Japan, Tokyo

Machin, A. (2013) *Negotiating Climate Change: Radical Democracy and the Illusion of Consensus* Zed Books, London

Miles, M. B., & Huberman, A. M. (1994) *Qualitative data analysis: An expanded sourcebook* Sage, Thousand Oaks, CA

Moore, T., de Haan, F., Horne, R., and Gleeson, B. (2017) *Urban Sustainability Transitions - Australian Cases- International Perspectives* Springer Japan, Tokyo

MK Smart (2014) Spotligh interviews - John Miles (

http://www.mksmart.org/blog/2014/10/10/spotlight-interviews-john-miles/) accessed 28 May 2018

MKC (2010) Milton Keynes low-carbon living strategy (https://www.milton-keynes.gov.uk/assets/attach/7075/Low_Carbon_Living_Strategy_-_final.pdf) accessed 28 May 2018

MKC (2011) Milton Keynes low-carbon action plan (https://www.milton-keynes.gov.uk/assets/attach/7076/Low_Carbon_action_plan_-__2011.pdf) accessed 28 May 2018

MKC (2012a) Employment technical paper: The Milton Keynes economy (http://www.milton-keynes.gov.uk/planning-policy/documents/eMPLOYMENT_tECHINCAL_pAPER_FINAL_16-05-2012.pdf) accessed 28 May 2018

MKC (2012b) Future-Ready MK (https://connect.innovateuk.org/documents/3130726/3794125/Feasibility+Study+-+Milton+Keynes+Council.pdf) accessed 28 May 2018

MKC (2013) Plugged in Places (PIP) and Electric Vehicle fact sheet (https://www.milton-keynes.gov.uk/assets/attach/13853/PIP_and_EV_Fact_Sheetl_Feb_2013_V2.pdf) accessed 28 May 2018

MKF2050 (2016) Milton Keynes: Making a great city greater (http://www.mkfutures2050.com/images/pdfs/reports/MK-Futures-2050-Full-Report-printable.pdf) accessed 28 May 2018

Montaner, J. J. C., Kortuem, G., & Foell, S. (2015) Smart community energy initiatives in Smart Cities: Learning collectively about energy (http://oro.open.ac.uk/43773/1/Learning_collectively_about_energy.pdf) accessed 28 May 2018

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014) "Current trends in Smart City initiatives: Some stylised facts" *Cities* 38 25-36

Okada, A., Wolff, A. & Mikroyannidis, A. (2015) Fostering young smart citizens through personal learning environments for urban inquiries (http://oro.open.ac.uk/44298/) accessed 28 May 2018

OneMK (2016) MotionMap: Free Milton Keynes app to track people and vehicles to be launched (http://www.onemk.co.uk/motionmap/story-29430588-detail/story.html) accessed 28 May 2018

Osborne Clarke (2015) Financing the commercialisation of smart city technology (http://www.osborneclarke.com/media/filer_public/4e/b1/4eb1e78a-6249-4701-85d7-b9ae123c6f81/financing_the_commercialisation_of_smart_city_technology.pdf) accessed 28 May 2018

Potter, S., Valdez, A.M., Cook, M. & Langendahl, P. (2015) "Governance in niche development for a transition to a new mobility regime" In *International Sustainability Conference* 2015, 25-28 August 2015, University of Sussex

PRP Architects, (2010) Milton Keynes - a sustainable future: a low carbon prospectus (https://www.milton-keynes.gov.uk/environmental-health-and-trading-standards/mk-low-carbon-living/low-carbon-prospectus) accessed 28 May 2018

Raven, R. (2006) "Towards alternative trajectories? Configurations in the Dutch electricity regime" *Research Policy* 35 581-595

Rotmans, J., & Loorbach, D. (2010) *Towards a better understanding of transitions and their governance. A systemic and reflexive approach. Transitions to sustainable development. New directions in the study of long term transformative change* Routledge, NY

Shapiro, J. M. (2006) "Smart cities: quality of life, productivity, and the growth effects of human capital" *The review of economics and statistics* 88(2) 324-335

Sheffield Smart Lab (2015) Citizen Data Portal and Trip Planner (http://www.sheffieldsmartlab.co.uk/finalists-city-centre-vibrancy-1/2015/11/26/citizen-data-portal-trip-planner) accessed 28 November 2017

Smith, A., & Stirling, A. (2008) Social-ecological resilience and socio-technical transitions: critical issues for sustainability governance - working papers from the STEPS Centre (http://www.steps-centre.org/PDFs/STEPS%20Working%20Paper_Transitions.pdf) accessed 28 May 2018

Smith, A., & Raven, R. (2012) "What is protective space? Reconsidering niches in transitions to sustainability" *Research policy* 41(6) 1025-1036

Söderström, O., Paasche, T., & Klauser, F. (2014) "Smart cities as corporate storytelling" *City* 18(3) 307-320

Transport Innovation Task and Finish Group (2016) Report March 2016 (http://goo.gl/gIvhZ0) accessed 28 May 2018

Truffer, B., Murphy, J. T., & Raven, R. (2015) "The geography of sustainability transitions: Contours of an emerging theme" *Environmental Innovation and Societal Transitions* 17 63-72

TSB (2013) Future cities demonstrator competition feasibility studies interim summary report (https://connect.innovateuk.org/documents/3130726/6091879/Future+Cities+Feasibility+Studies+-+Interim+Report.pdf/4ab345d6-105c-4a88-867f-12e7b976780b) accessed 28 May 2018

TSB and Arup (2013) Solutions for cities: An analysis of the feasibility studies from the Future Cities Demonstrator Programme (https://www.arup.com/publications/research/section/solutions-for-cities) accessed 28 May 2018

Townsend, A. M. (2013) *Smart cities: Big data, civic hackers, and the quest for a new utopia* WW Norton & Company, New York

UKAuthority (2016) BT to build on MK Data Hub for Manchester (http://www.ukauthority.com/smart-places/entry/6397/bt-to-build-on-mk-data-hub-for-manchester) accessed 28 May 2018

UN (2014) World Urbanization prospects - 2014 Revision (https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf) accessed 28 May 2018

Valdez, A. M., Cook, M., Potter, S., & Langendahl, P. A. (2018) "Exploring participatory visions of smart transport in Milton Keynes" *Proceedings of the Institution of Civil Engineers-Engineering Sustainability* 171(4)

Van Hulst, M. (2012) "Storytelling, a model of and a model for planning" *Planning Theory* 11(3) 299-318

Vanolo, A. (2013) "Smartmentality: The smart city as disciplinary strategy" *Urban Studies* 51(5) 883-898

Vilajosana, I., Llosa, J., Martinez, B., Domingo-Prieto, M., Angles, A., & Vilajosana, X. (2013) "Bootstrapping smart cities through a self-sustainable model based on big data flows" *IEEE Communications Magazine* 51(6) 128-134

Williamson, B. (2015) "Educating the smart city: Schooling smart citizens through computational urbanism" *Big Data & Society* 2(2)

Wolff, A., Gooch, D., Mir, U., Cavero, J., & Kortuem, G. (2015) Removing barriers for citizen participation to urban innovation (http://oro.open.ac.uk/43854/) accessed 30 May 2018

Wolff, A., Kortuem, G., & Cavero, J. (2015) Towards smart city education. In Sustainable Internet and ICT for Sustainability (http://oro.open.ac.uk/42549/1/Sustain-OU-CR.pdf) accessed 28 May 2018

Wolfram M. (2012) "Deconstructing smart cities: an intertextual reading of concepts and practices for integrated urban and ICT development" in Schrenk M., Popovich V. V., Zeile P., Elisei P eds. *Re-Mixing the City: Towards Sustainability and Resilience?* Real Corp, Schwechat, Austria, 171–181

[i] The politics of circumstances, factors and coalitions, rather than explicit ideological notions or moral and ethical premises.